



QD-QA-019
REVISION E
EFFECTIVE DATE: February 2, 2006

ORGANIZATIONAL INSTRUCTION

INSPECTION OF PROPELLANT AND EXPLOSIVE DEVICES

OPR(s)

OPR DESIGNEE

**QD10, QD20, QD30, Gary W. Kennedy
and QD40**

**CHECK THE MASTER LIST AT: <http://inside.msfc.nasa.gov/MIDL/>
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

| Organizational Instruction | | |
|---|------------------------|-------------|
| Title: Inspection of Propellant and Explosive Devices | QD-QA-019 | Revision: E |
| | Date: February 2, 2006 | Page 2 of 6 |

DOCUMENT HISTORY LOG

| Status (Baseline/ Revision/ Canceled) | Document Revision | Effective Date | Description |
|--|----------------------|-------------------|---|
| Baseline | | 10/14/97 | |
| Revision | A | 7/1/99 | Changes made to reflect new organization code changes and/or Changes made to reflect new directives renumbering scheme and to incorporate the corrective action of NCR 266 |
| Revision | B | 9/09/02 | Format and numbering change to implement requirements of QS-A-001 rev F. |
| Revision | C | 09/18/03 | Change of approving authority. Changes made to sections 1.3 and 10 to replace the reference of QS10 to a Quality Assurance person. |
| Revision | D | 10/1/04 | Updated OI to implement HQ Rules Review in accordance with CAITS Action # 04-DA-01-0387) (Utilizing the word "Shall" for all requirements, removing ambiguity, removing non-requirements, etc.) |
| Revision | E | 2/2/05 | Revised steps 4.9, 4.11, and 5.1. |

CHECK THE MASTER LIST AT: <http://inside.msfc.nasa.gov/MIDL/>
 VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

| Organizational Instruction | | |
|---|------------------------|-------------|
| Title: Inspection of Propellant and Explosive Devices | QD-QA-019 | Revision: E |
| | Date: February 2, 2006 | Page 3 of 6 |

1. SCOPE

- 1.1 Scope: This instruction provides requirements for inspection of solid propellant, solid rocket motors, hypergolic propellant, pyrophoric chemicals, and explosive devices (pyros).
- 1.2 Purpose: To ensure safe and consistent inspection of propellant and explosive devices.
- 1.3 Applicability: This procedure applies to S&MA Quality Assurance personnel, during inspection and assembly operations involving solid propellant, solid rocket motors, hypergolic propellant, pyrophoric chemicals, and explosive devices. This procedure may be incorporated by reference into MSFC in-house contracts.

2. APPLICABLE DOCUMENTS

| | |
|---------------|--|
| QS-QA-005 | Packaging, Handling and Moving Program Critical Hardware |
| MWI 3410.1 | Personnel Certification Program |
| MWI 8715.10 | Explosives, Propellant and Pyrotechnics Program |
| MSFC-STD-1800 | Electrostatic Discharge (ESD) Control for Propellant and Explosive Devices |

3. DEFINITIONS

- a. Deflagration: A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and be accelerated without input of heat from another source. This is a surface phenomenon with the reaction proceeding towards the unreacted material along the surface at subsonic velocity. The effect of a true deflagration under confinement is an explosion. Confinement of the reaction increases pressure, rate of reaction and temperature, and may cause transition into a detonation.
- b. Detonation: A violent chemical reaction within a chemical compound or mechanical mixture involving heat and pressure. This is a reaction which proceeds through the reacted material toward the unreacted material at a supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium forming a propagating shock wave which is originally of supersonic velocity.
- c. Electroexplosive Device: Any device that uses a difference in electrical potential to initiate an explosive reaction.
- d. Explosives: Includes any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, detonation, or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressure in the surrounding medium. This term applies to materials that either detonate or deflagrate.
- e. Hypergolic: Propellants which are self-igniting upon contact of fuel and oxidizer, without a spark or external aid.

| Organizational Instruction | | |
|---|------------------------|-------------|
| Title: Inspection of Propellant and Explosive Devices | QD-QA-019 | Revision: E |
| | Date: February 2, 2006 | Page 4 of 6 |

- f. Propellant: Any substance or combination of substances, liquid or solid, that when ignited, propels or provides thrust through a deflagration reaction. A propellant is an explosive that is suitable for effecting the controlled propulsion of a solid body.
- g. Pyrophoric: Chemicals which ignite spontaneously in air; usually used as an ignition source for liquid engines and hybrid rocket motors. A commonly used pyrophoric at MSFC is triethylaluminum/triethylborane or TEA/TEB.
- h. Pyrotechnic: Any item or device manufactured from explosive or chemical ingredients, including powdered metals, that is capable of deflagration or detonation. Pyrotechnic devices are generally designed to produce large quantities of heat and/or light instead of large volumes of high pressure gases. (Note: NASA uses the term “pyros” to refer to flight explosive devices.)

4. SAFETY & MISSION ASSURANCE REQUIREMENTS

NOTE: NASA and/or support contractor personnel shall perform or verify the performance of the following:

- 4.1 Verify that approved work authorizing documentation is available for all activities involving explosives. Contact the Industrial Safety Office engineer for approval of the procedure. Verify that all personnel are properly trained and certified. If the items to be inspected are flight hardware, consult the applicable project office to determine whether the items are Program Critical Hardware (PCH). If PCH requirements apply, refer to QS-QA-005 “Packaging, Handling, and Moving Program Critical Hardware”.
- 4.2 Refer to drawings, procedures or shipping documents to determine the type and amount of explosive or propellant being handled or inspected. A Material Safety Data Sheet (MSDS) should be available, if not, contact the Industrial Safety Office.
- 4.3 Refer to MSFC-STD-1800, paragraph 5.2, to determine whether appropriate ESD mitigation techniques have been incorporated into the work authorizing document. An ESD Control Plan, Hazard Analysis, or mitigation techniques shall be defined and appropriate steps shall be available in the work authorizing document. Contact the Industrial Safety Office for resolution of any questions. Obtain equipment and materials as specified.
- 4.4 Verify that personnel and explosive limits are posted in the area where explosives are to be handled or inspected. This will be limited to personnel performing the operation and a minimum number of observers, and only the amount of explosive needed for the operation. Contact the Safety engineer, if questions arise concerning other operations in the vicinity.
- 4.5 Verify that appropriate fire symbols (refer to NSS 1740.12) are posted on the buildings or that vehicles have proper placards.
- 4.6 Refer to the drawing or work authorizing document for inspection criteria. Solid propellant is normally inspected for cracks, voids, liner or inhibitor unbonds, and leaching of ammonium perchlorate crystals. Electroexplosive devices normally have

| Organizational Instruction | | |
|---|------------------------|-------------|
| Title: Inspection of Propellant and Explosive Devices | QD-QA-019 | Revision: E |
| | Date: February 2, 2006 | Page 5 of 6 |

faraday caps or shorting springs installed, threads should be free of dirt, explosive material or other contamination, and pins should not be broken or bent. Generate appropriate nonconformance documentation if required. Inspections shall be performed in an area approved by the Industrial Safety Office engineer.

- 4.7 For items with sensitivity to radio frequency (RF) energy, ensure RF silence is maintained in the area during the operation. Contact the Safety engineer for assistance if required.
- 4.8 Verify appropriate weather constraints are included in the work authorizing documentation, and verify compliance.
- 4.9 Verify that all inspection, measurement, and test equipment (IM&TE) used to perform a requirement (I.E. resistance check, torque, etc.) is calibrated and that the serial number and calibration due date are recorded on work authorizing documentation. All test set-ups shall be reviewed and approved..
- 4.10 For items being shipped, received, or disposed of, refer to MWI 8715.10 "Explosives, Propellant, And Pyrotechnics Program", or the reference documents listed in paragraph 5 for Redstone Arsenal requirements, procedures and points-of-contact.
- 4.11 Verify that the explosive devices color coding requirements have been identified in the appropriate documentation and that all personnel involved have been properly briefed. The following color coding requirements are listed as reference:
 - a. NSTS 08060

| | |
|-----------------------|----------|
| Flight | No color |
| Live Engineering Unit | Blue |
| Inert | Red |
 - b. NSS 1740.12

| | |
|-----------------------|----------|
| Flight | No color |
| Live Engineering Unit | Red |
| Inert | Blue |
- 4.12 If visitors are required in the area, operations may be discontinued at the discretion of quality, safety or engineering personnel. Visitors are required to wear protective equipment as required for their purpose, and be briefed on the hazards. Personnel limits shall be adhered to.
- 4.13 Hypergolic and pyrophoric chemicals are shipped and stored in approved containers. Extreme caution must be exercised in working around systems with hypergolic or pyrophoric chemicals installed, due to health and fire hazards. Only properly trained personnel are allowed in the area at the direction of the test engineer. Consult approved procedures for appropriate Personnel Protective Equipment (PPE).

| Organizational Instruction | | |
|---|------------------------|-------------|
| Title: Inspection of Propellant and Explosive Devices | QD-QA-019 | Revision: E |
| | Date: February 2, 2006 | Page 6 of 6 |

4.14 Questions regarding storage of solid propellant, solid rocket motors, igniters, explosive devices, hypergolic propellant, and pyrophoric chemicals may be referred to the Safety engineer.

4.15 Nonconforming items shall be identified with Withhold Tags (MSFC Tag 10) and appropriate nonconformance documentation generated.

5. NOTES

5.1 Reference Documents. The following reference documents provide additional information concerning the subject of Propellant and Explosive device inspection.

ET10-OWI-009 Transportation and Handling of Propellant, Rocket Motors and Explosive Devices

ET10-OWI-010 Temporary Storage of Explosives, Solid Propellant and Pyrophoric Chemicals in the Propulsion and Fluid Systems Test Division

ET10-OWI-011 Explosive Material Transfer

DEPARTMENT OF THE ARMY

PAMPHLET 385-64 Ammunition and Explosives Safety Standards

5.2 Directive Replacement. This Directive replaces QS10-QA-019, Revision D, Inspection of Propellant and Explosive Devices.

6. SAFETY PRECAUTIONS AND WARNING NOTES

None.

7. APPENDICES, DATA, REPORTS, AND FORMS

None.

8. RECORDS

None.

9. TOOLS, EQUIPMENT, AND MATERIALS

None.

10. PERSONNEL TRAINING AND CERTIFICATION

All S&MA personnel who handle or inspect explosives are required to be trained and certified in accordance with MWI 3410.1.

11. FLOW DIAGRAM

None.